The 3D representation of the new transformation from the terrestrial to the celestial system

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To study the sky from the Earth or to use navigation satellites, we need two reference systems, a celestial reference system, as fixed as possible with respect to the inertial frame, and a terrestrial reference system, rotating with the Earth. Additionally, we need a way to go from one reference system to the other. This transformation involves the Earth rotation rate, the polar motion, and the precession-nutation.
This transformation is done using an intermediate system, in which the Earth rotation it-self is corrected for. Previously one used an intermediate system related to the equinox; the new paradigm involved a point, denoted the Celestial Intermediate Origin (CIO), which, due to its kinematical property of "Non Rotating Origin", allows better describing the length-of-day of the Earth. The use or not of the CIO only affects this intermediate frame. The new transformation system involving the CIO is additionally much simpler. Moreover, the use of the CIO allows an elegant separation between the polar motion, the precession nutation and the rotation rate variation. In this presentation we will show 3D representations that explain all this.